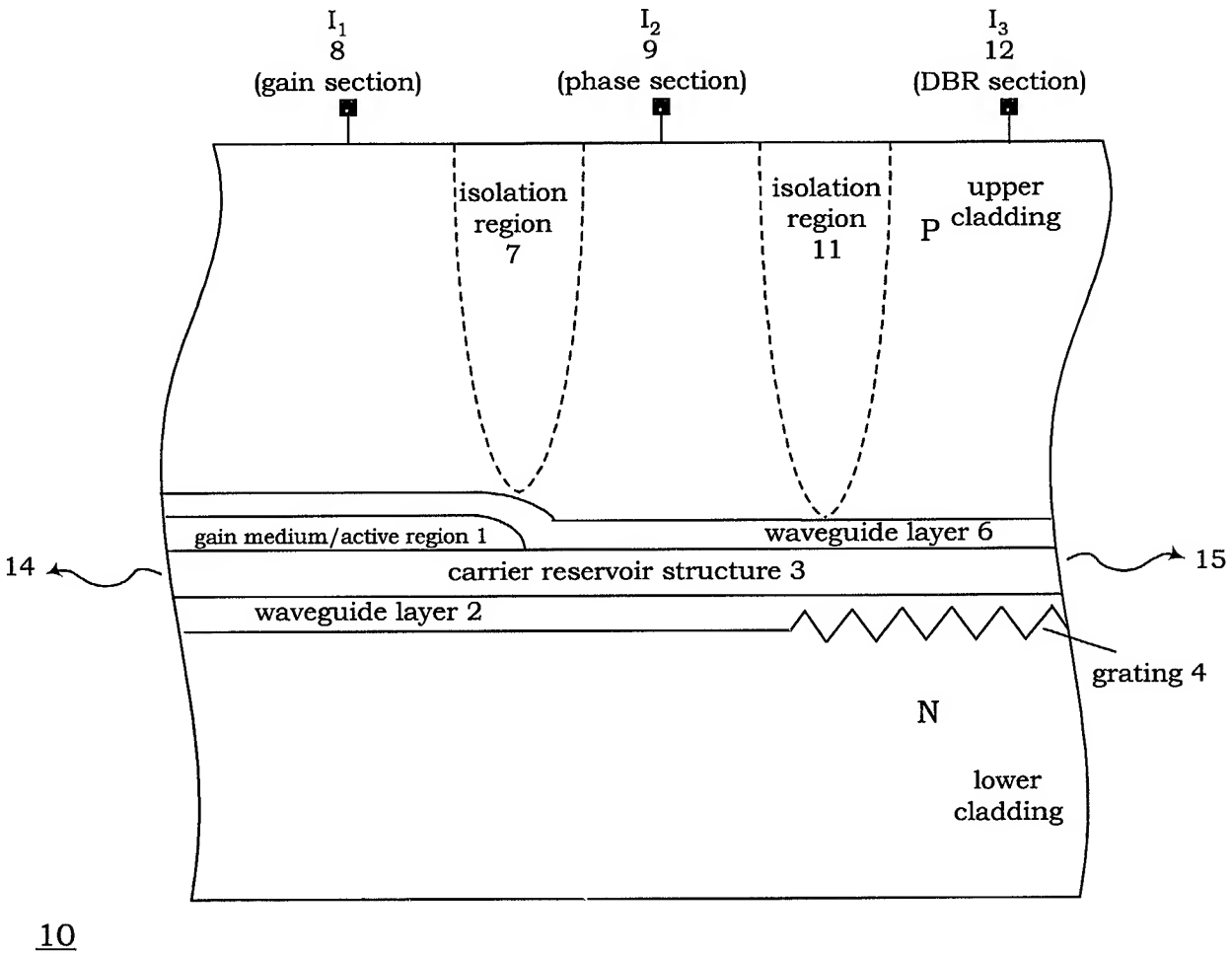


FIG. 1

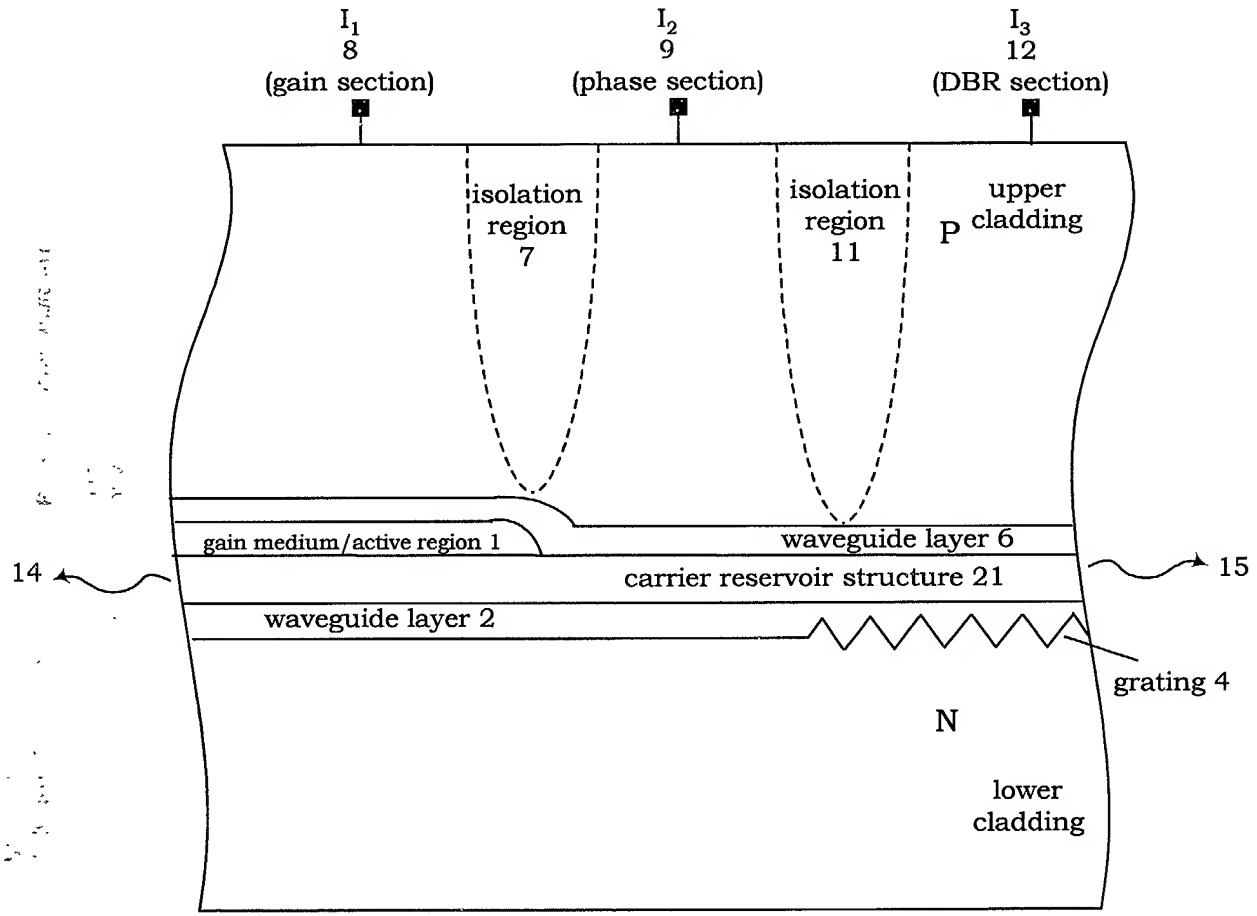

I1
8
(gain section)
I2
9
(phase section)
I3
12
(DBR section)
isolation region 7
isolation region 11
upper cladding
P
gain medium/active region 1
waveguide layer 6
14
15
carrier reservoir structure 21
waveguide layer 2
grating 4
N
lower cladding
20

FIG. 2

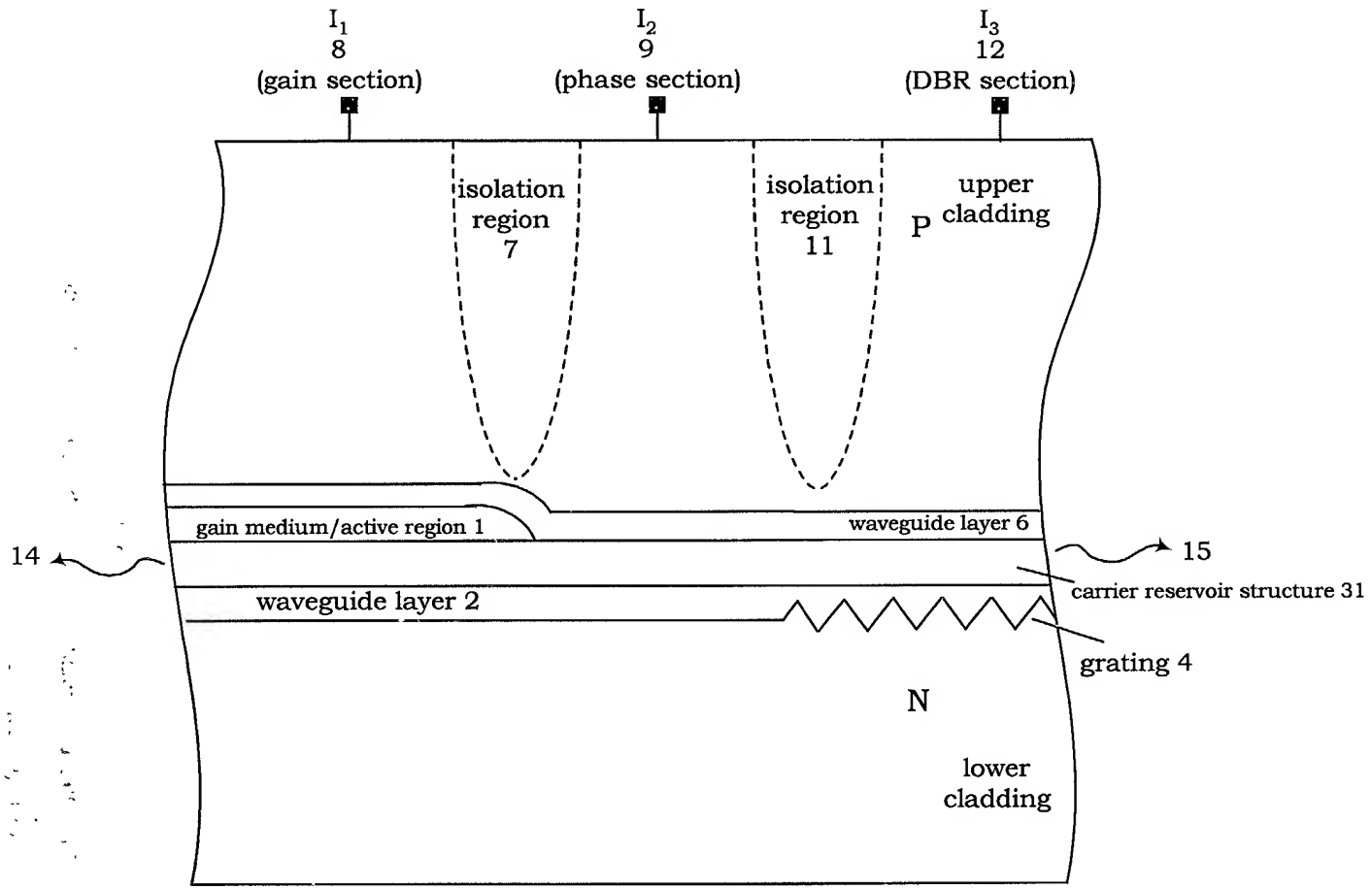


FIG. 3

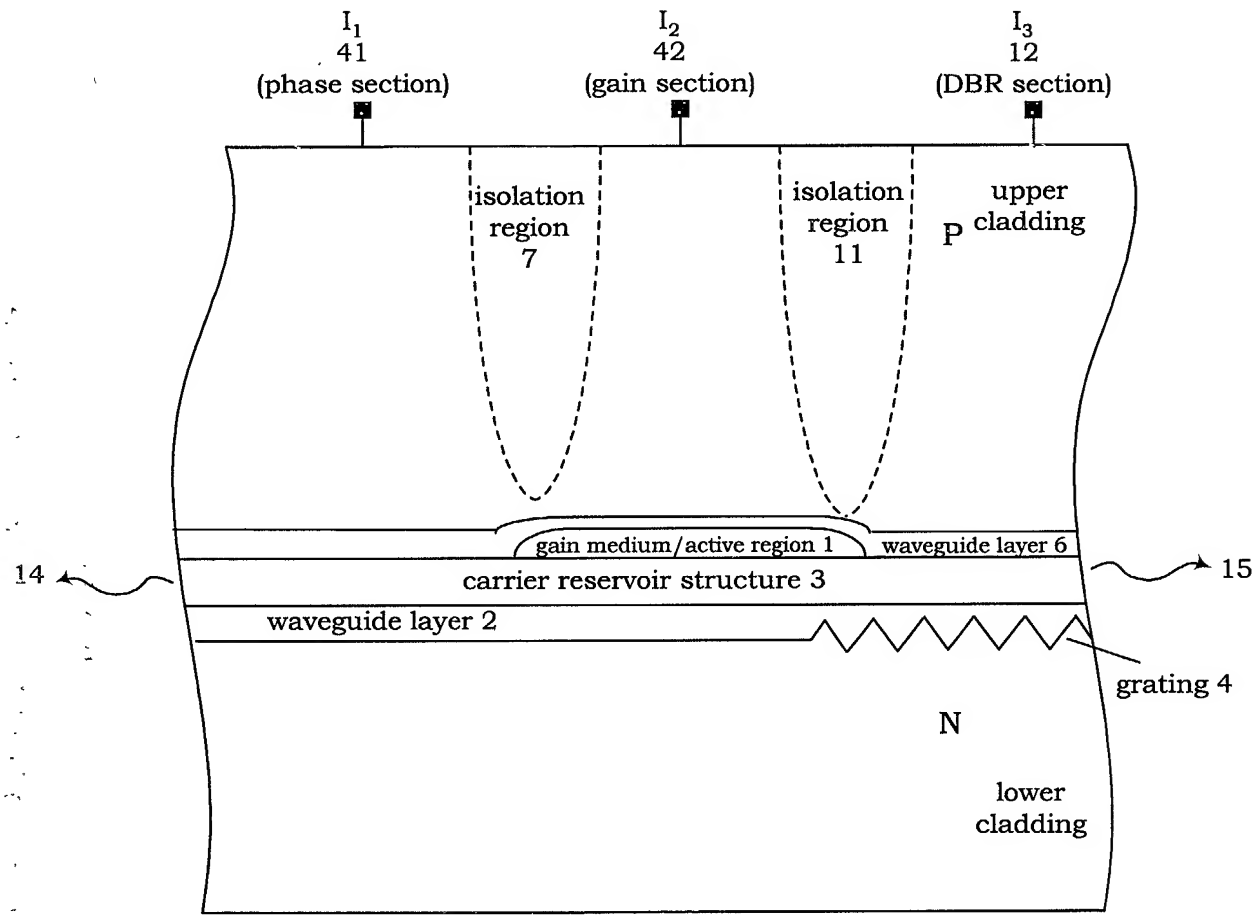


FIG. 4

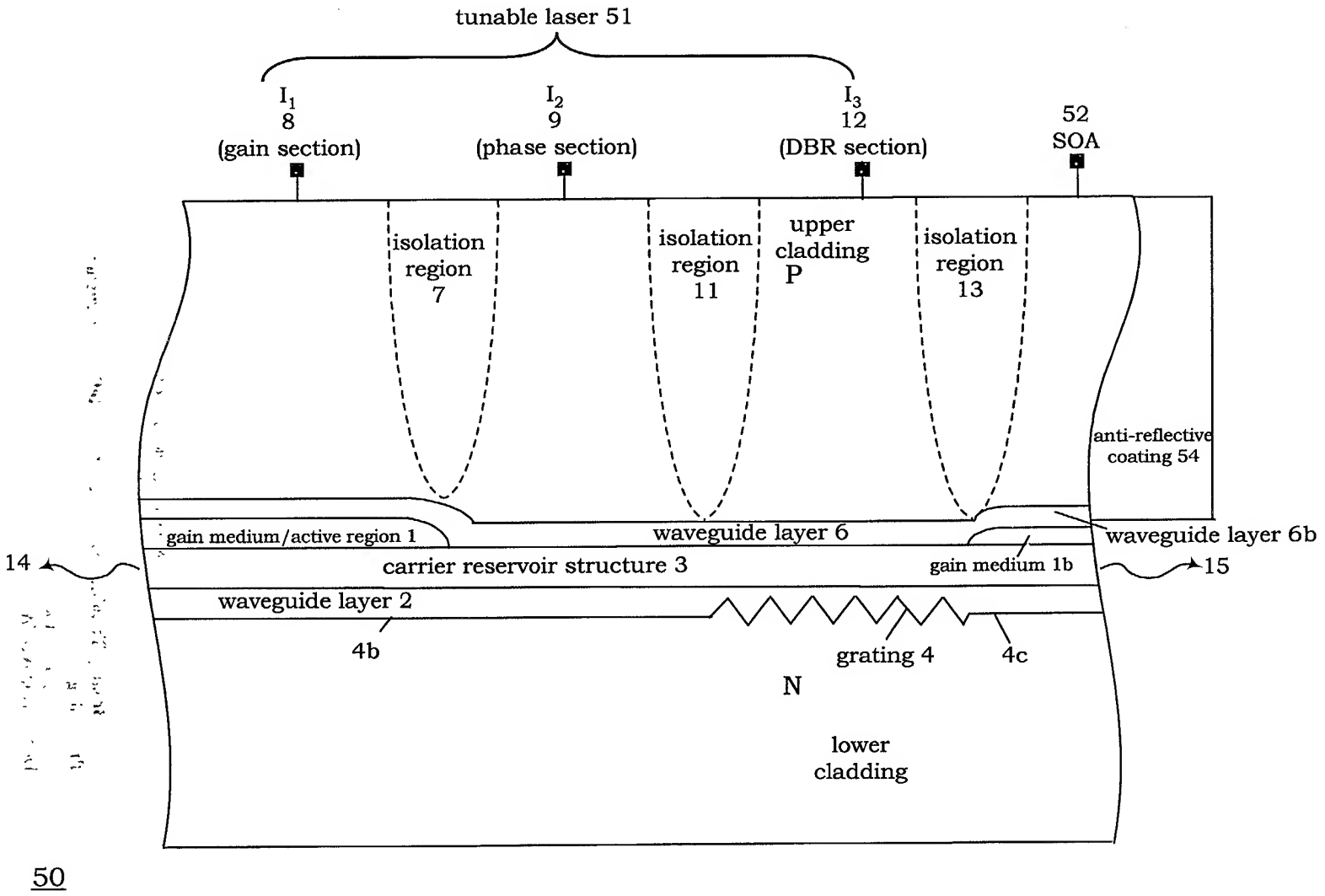

tunable laser 51
I_1
8
(gain section)
I_2
9
(phase section)
I_3
12
(DBR section)
52
SOA
isolation region 7
isolation region 11
upper cladding P
isolation region 13
anti-reflective coating 54
gain medium/active region 1
waveguide layer 6
waveguide layer 6b
14
carrier reservoir structure 3
gain medium 1b
15
waveguide layer 2
4b
grating 4
4c
N
lower cladding
50

FIG. 5

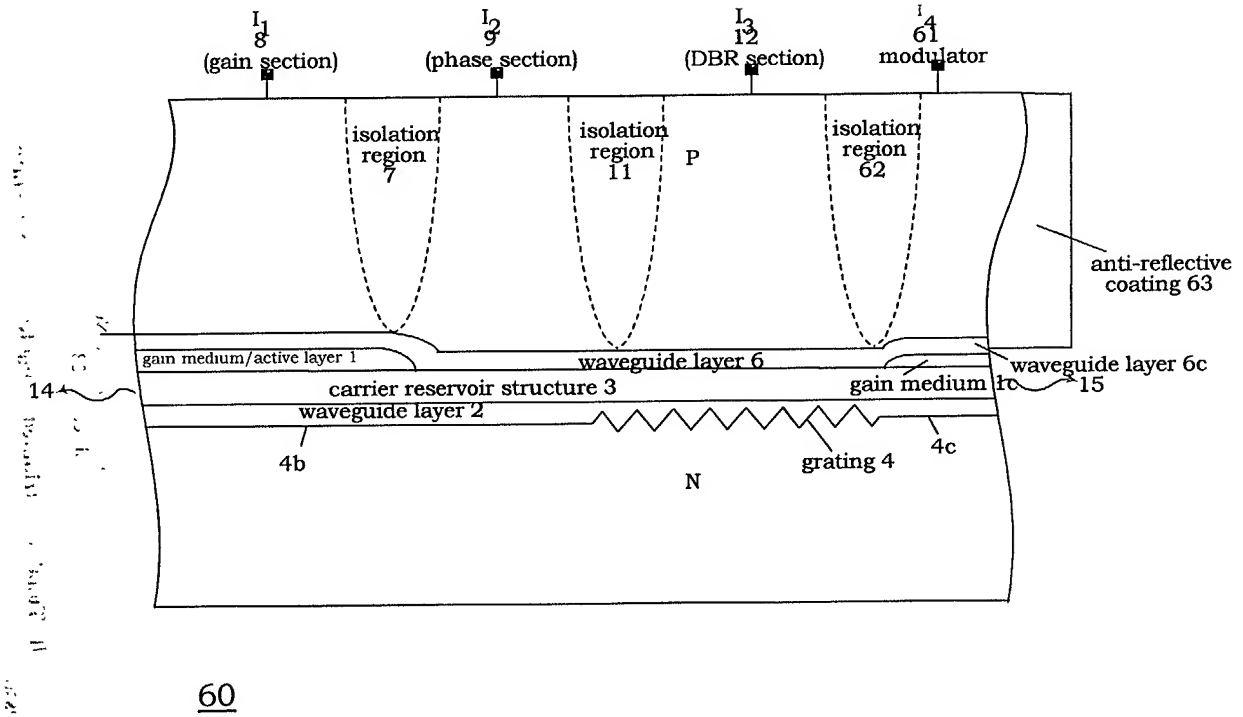
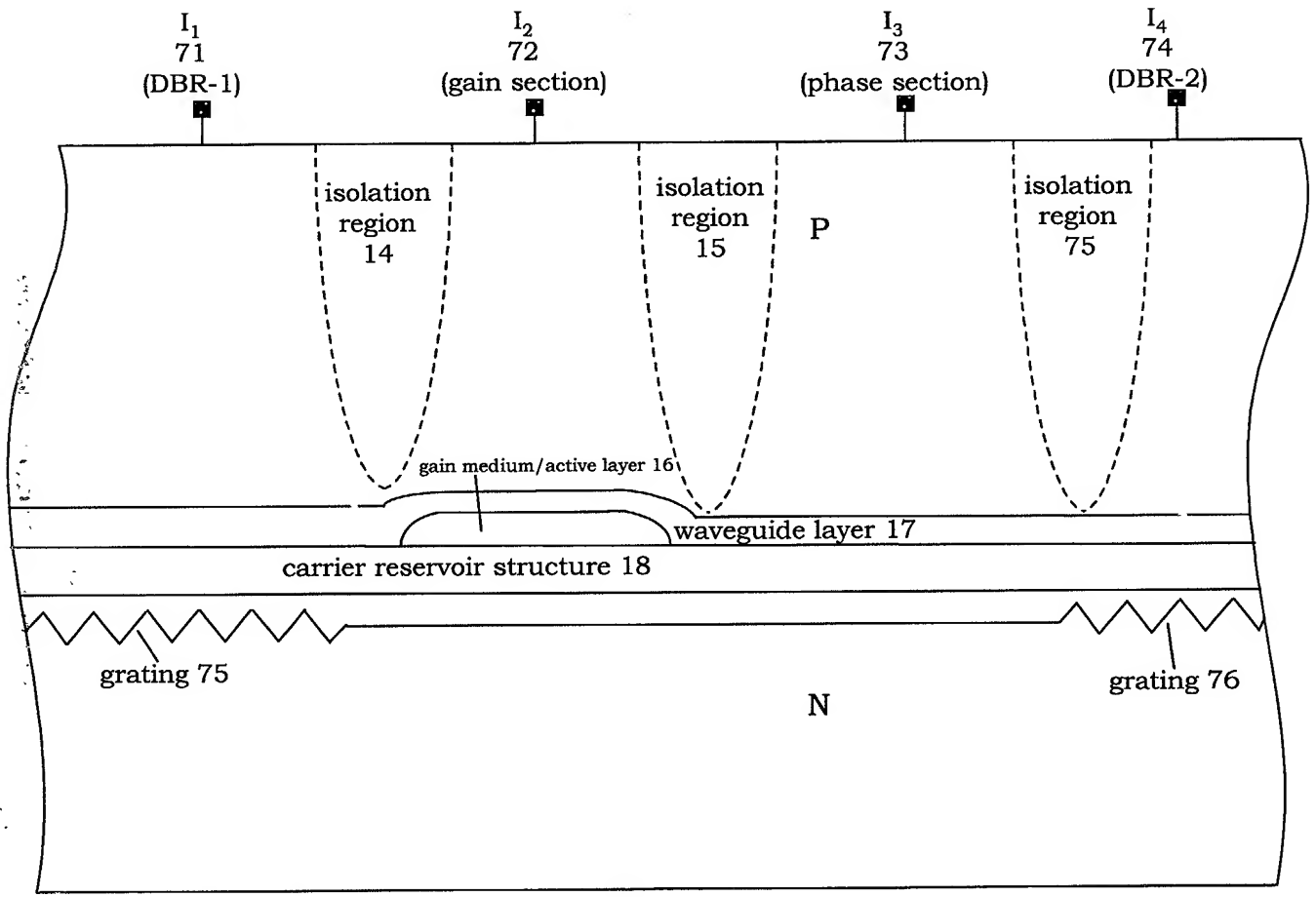


FIG. 6



70

FIG. 7

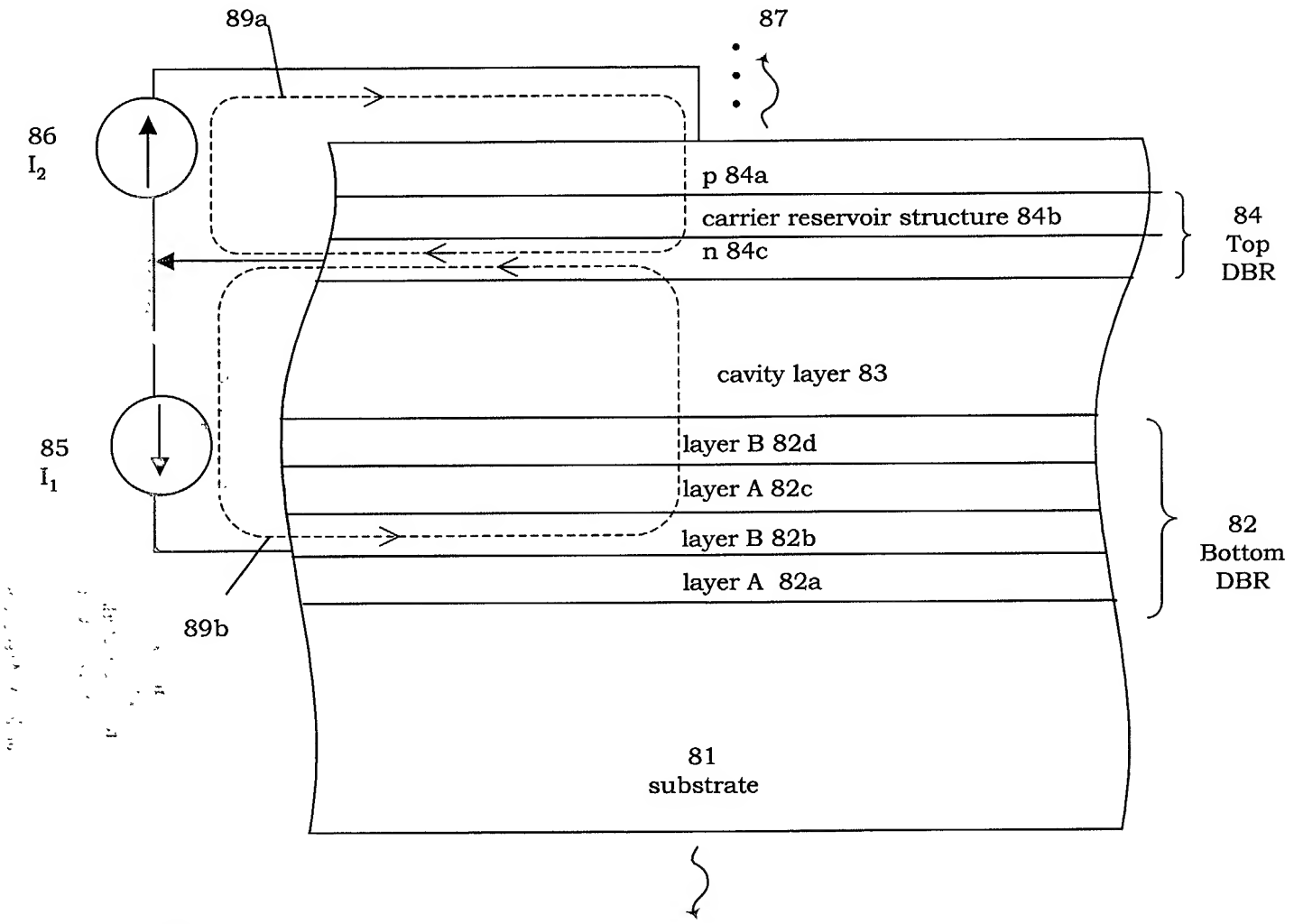


FIG. 8

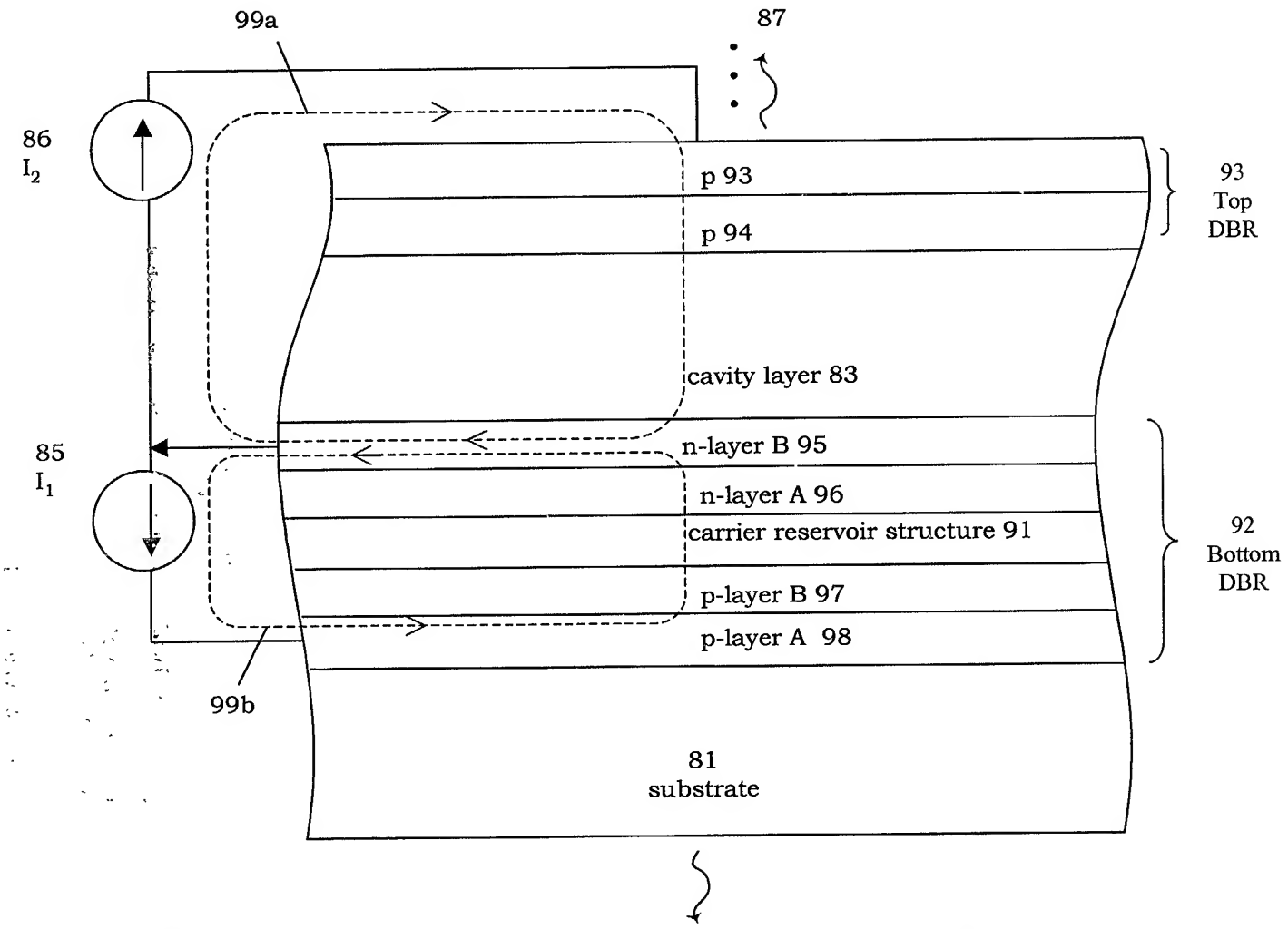

99a
87
86
I_2
p 93
p 94
93
Top
DBR
cavity layer 83
85
I_1
n-layer B 95
n-layer A 96
carrier reservoir structure 91
92
Bottom
DBR
p-layer B 97
p-layer A 98
99b
81
substrate
90
88

FIG. 9

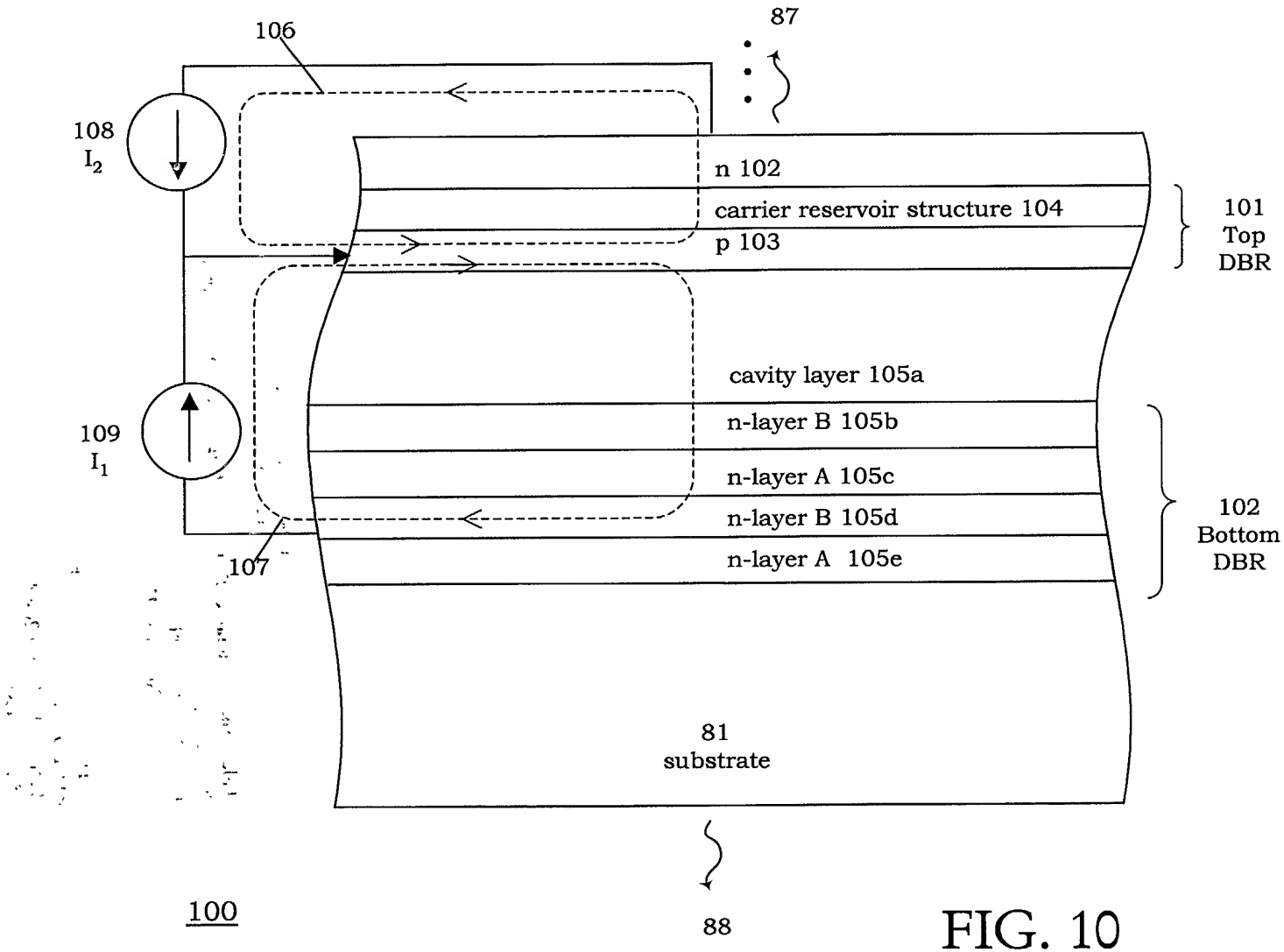

106
87
108
I_2
n 102
carrier reservoir structure 104
p 103
101
Top
DBR
cavity layer 105a
109
I_1
n-layer B 105b
n-layer A 105c
n-layer B 105d
n-layer A 105e
102
Bottom
DBR
107
81
substrate
100
88

FIG. 10

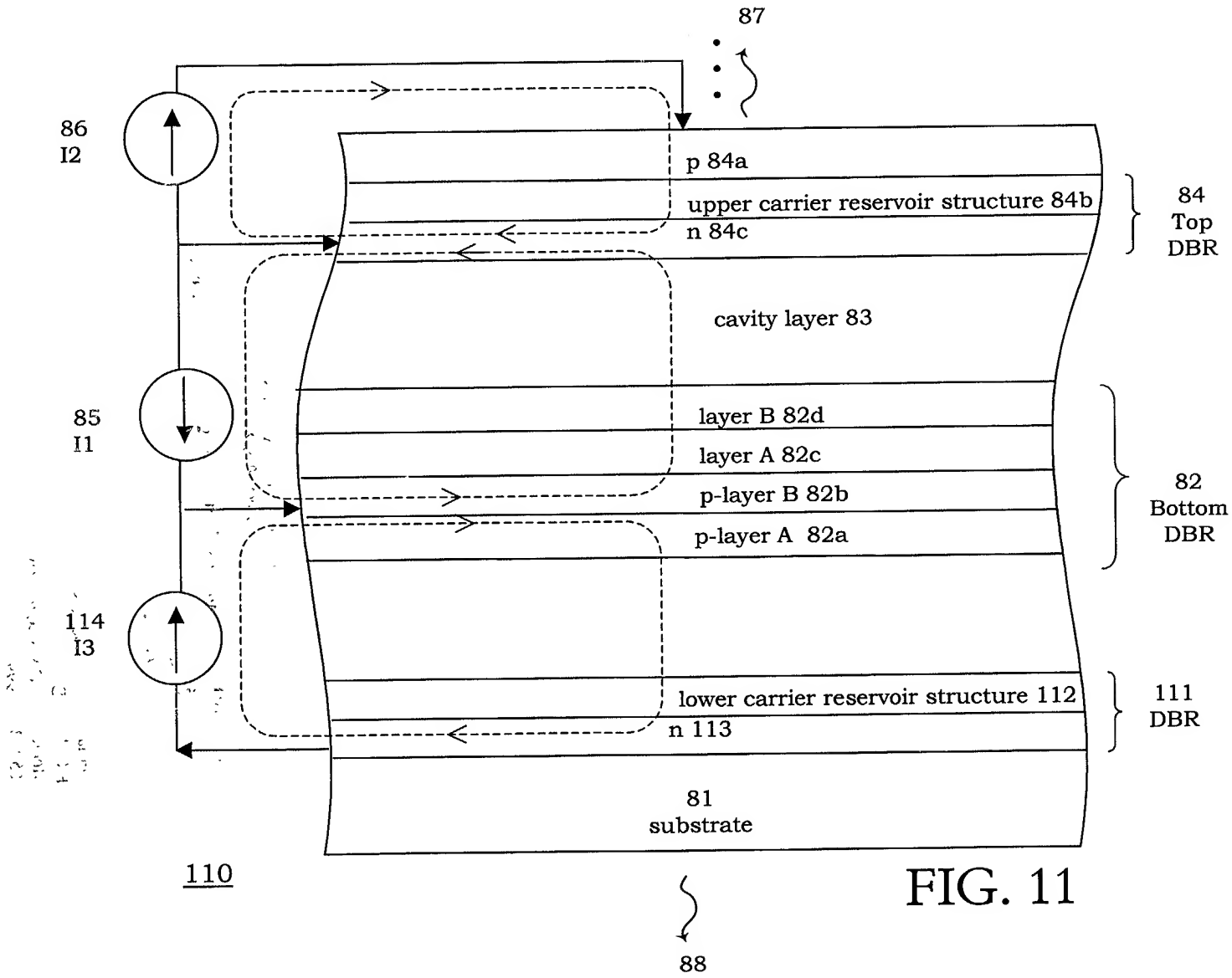


FIG. 11

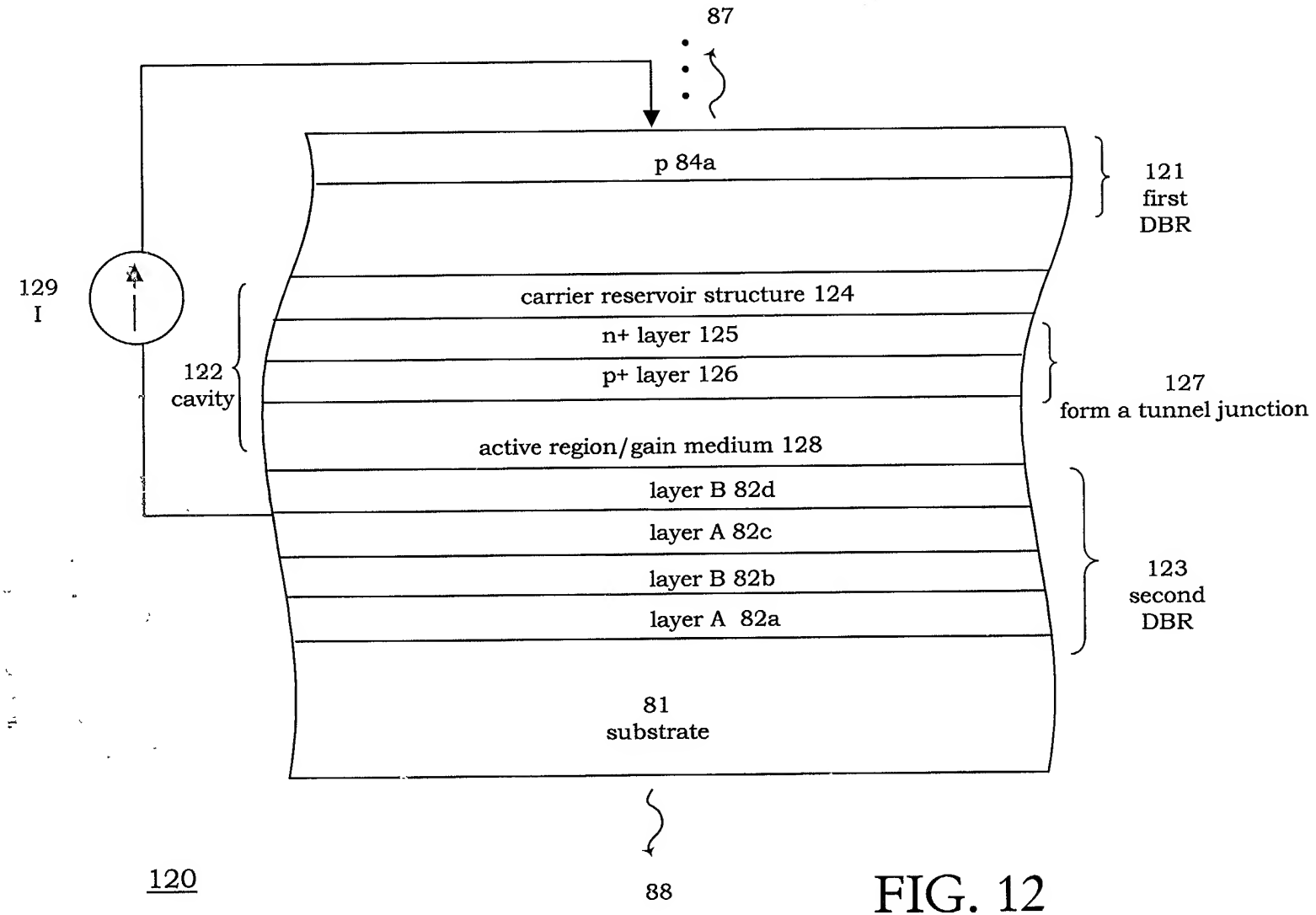
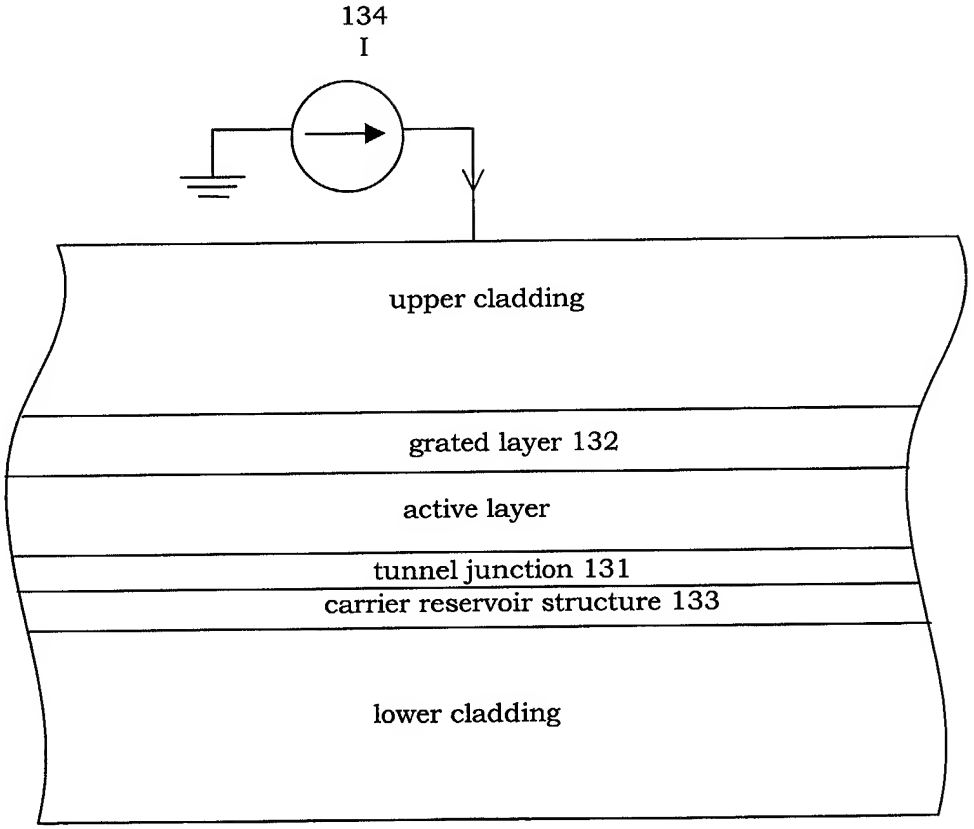
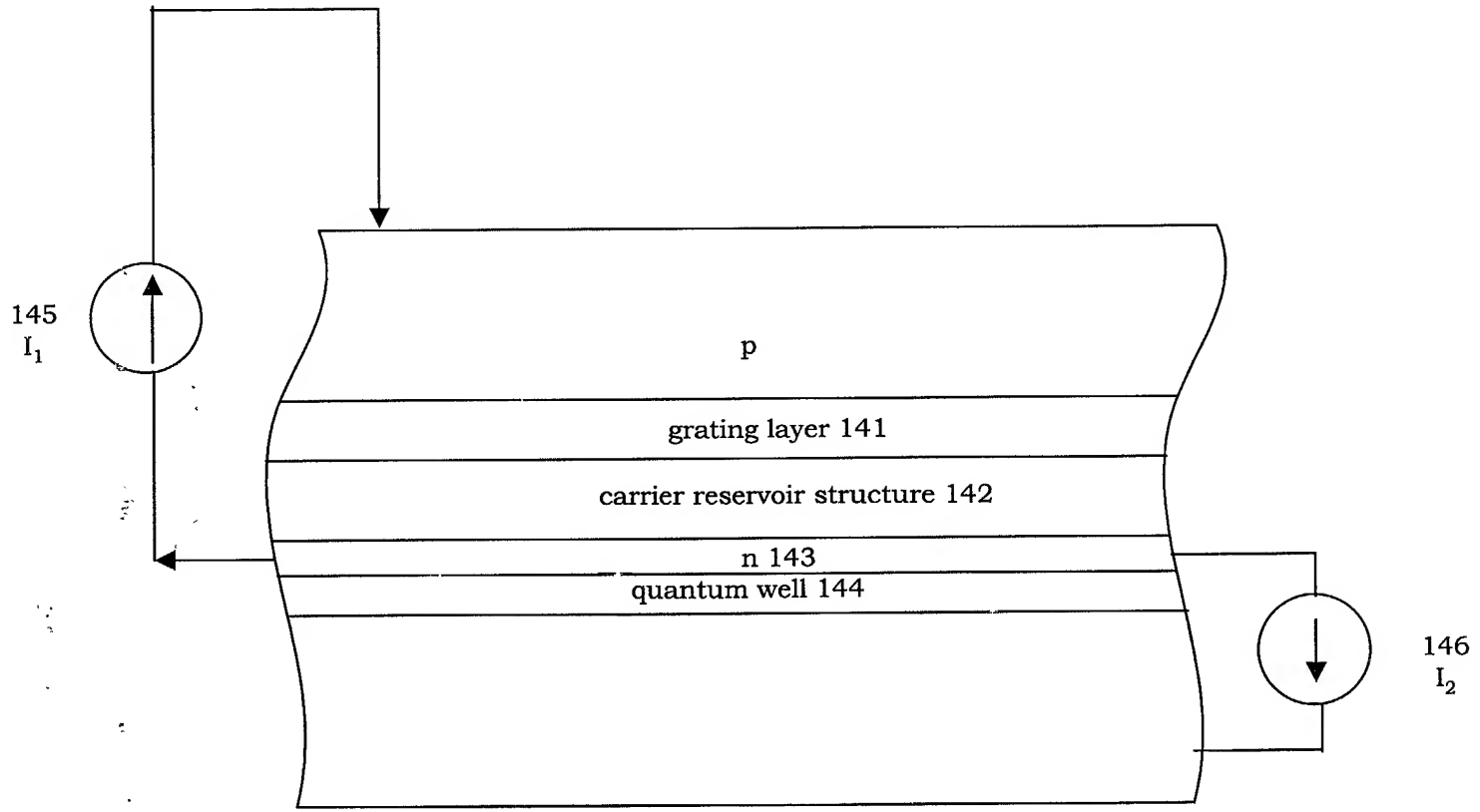


FIG. 12



130

FIG. 13


145
I_1
p
grating layer 141
carrier reservoir structure 142
n 143
quantum well 144
146
I_2

140

FIG. 14

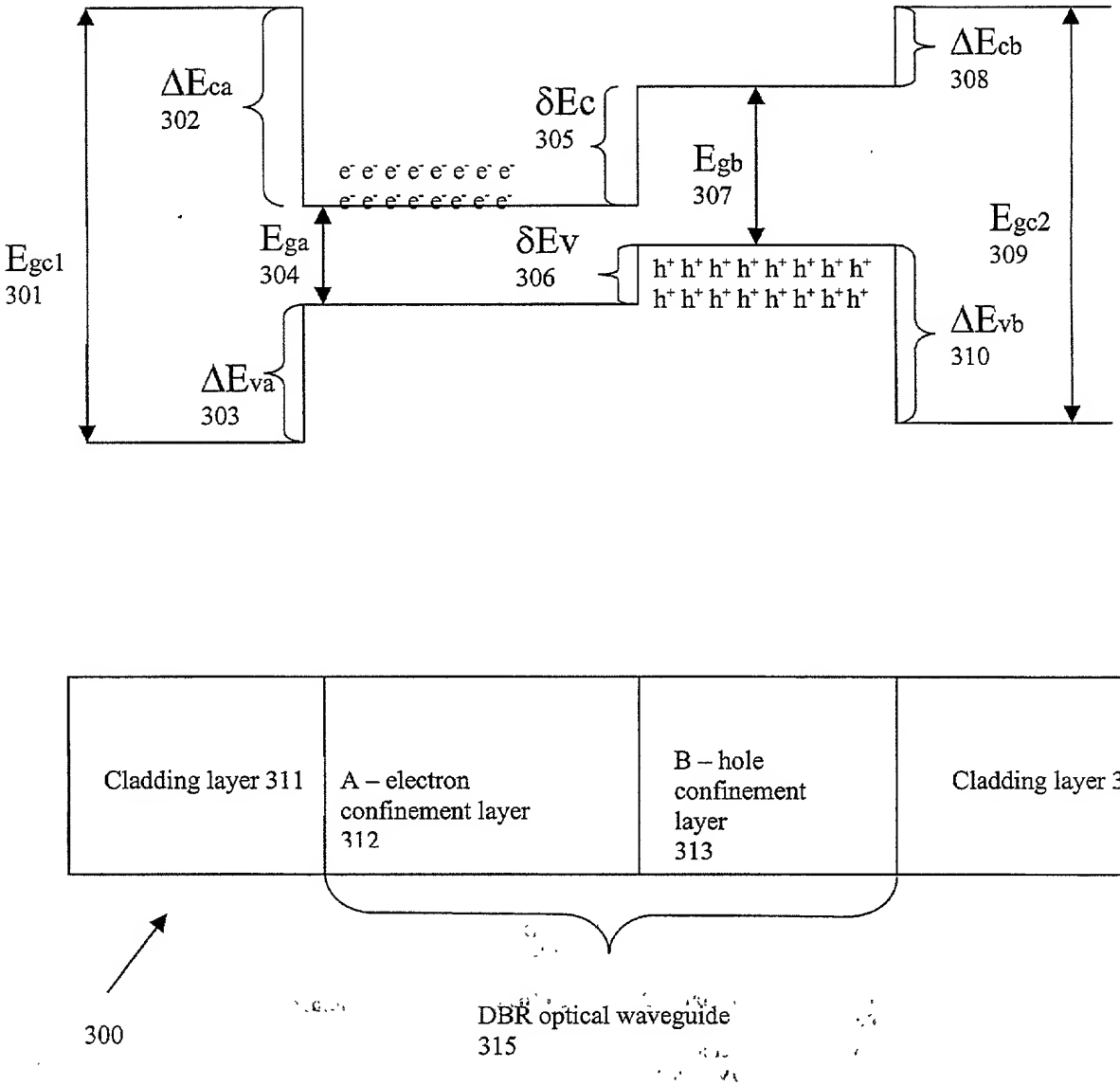
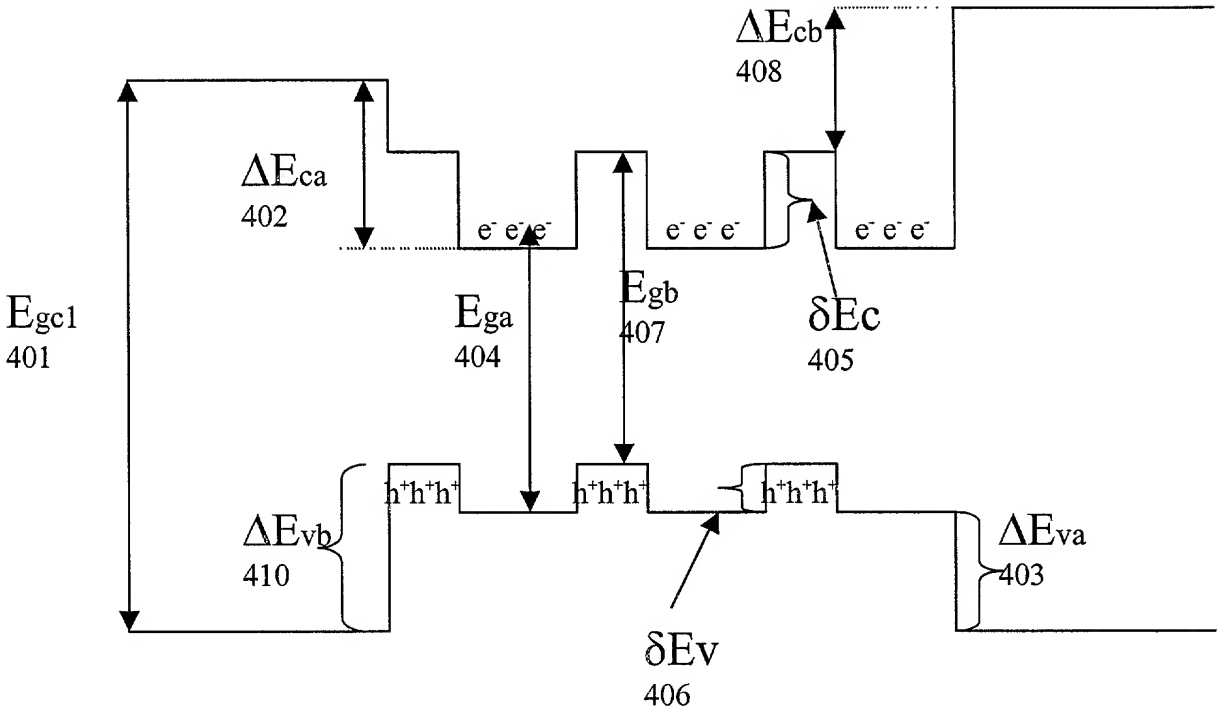
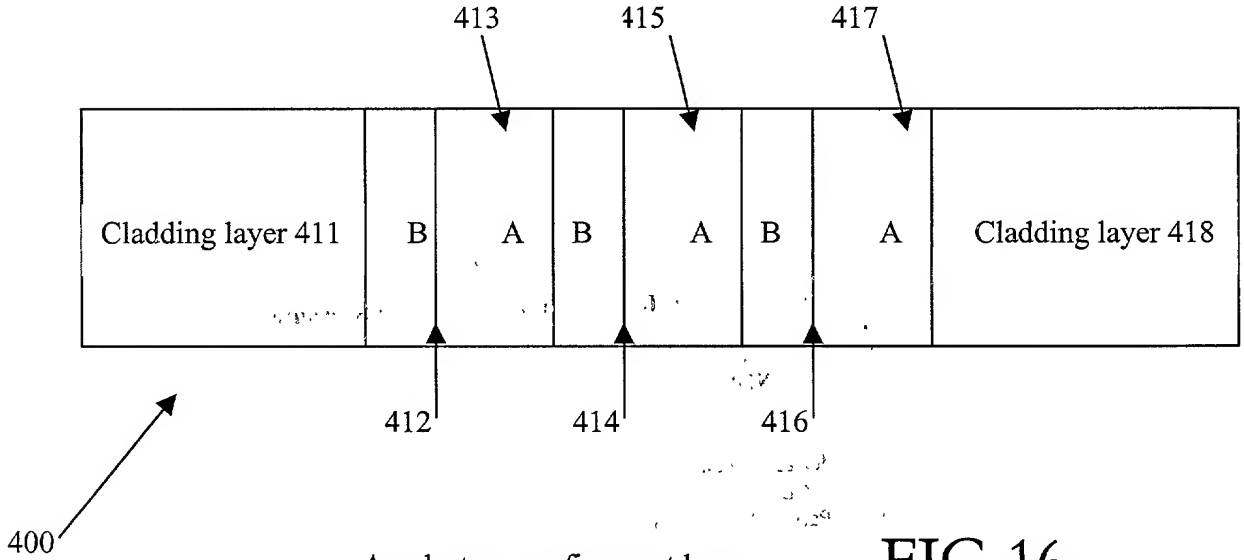

ΔEca
302
δEc
305
ΔEcb
308
Egb
307
e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻
e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻
Egc1
301
Ega
304
δEv
306
h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺
h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺
Egc2
309
ΔEva
303
ΔEvb
310
Cladding layer 311
A – electron confinement layer 312
B – hole confinement layer 313
Cladding layer 314
300
DBR optical waveguide 315

FIG. 15





A= electron confinement layer
B= hole confinement layer

FIG.16

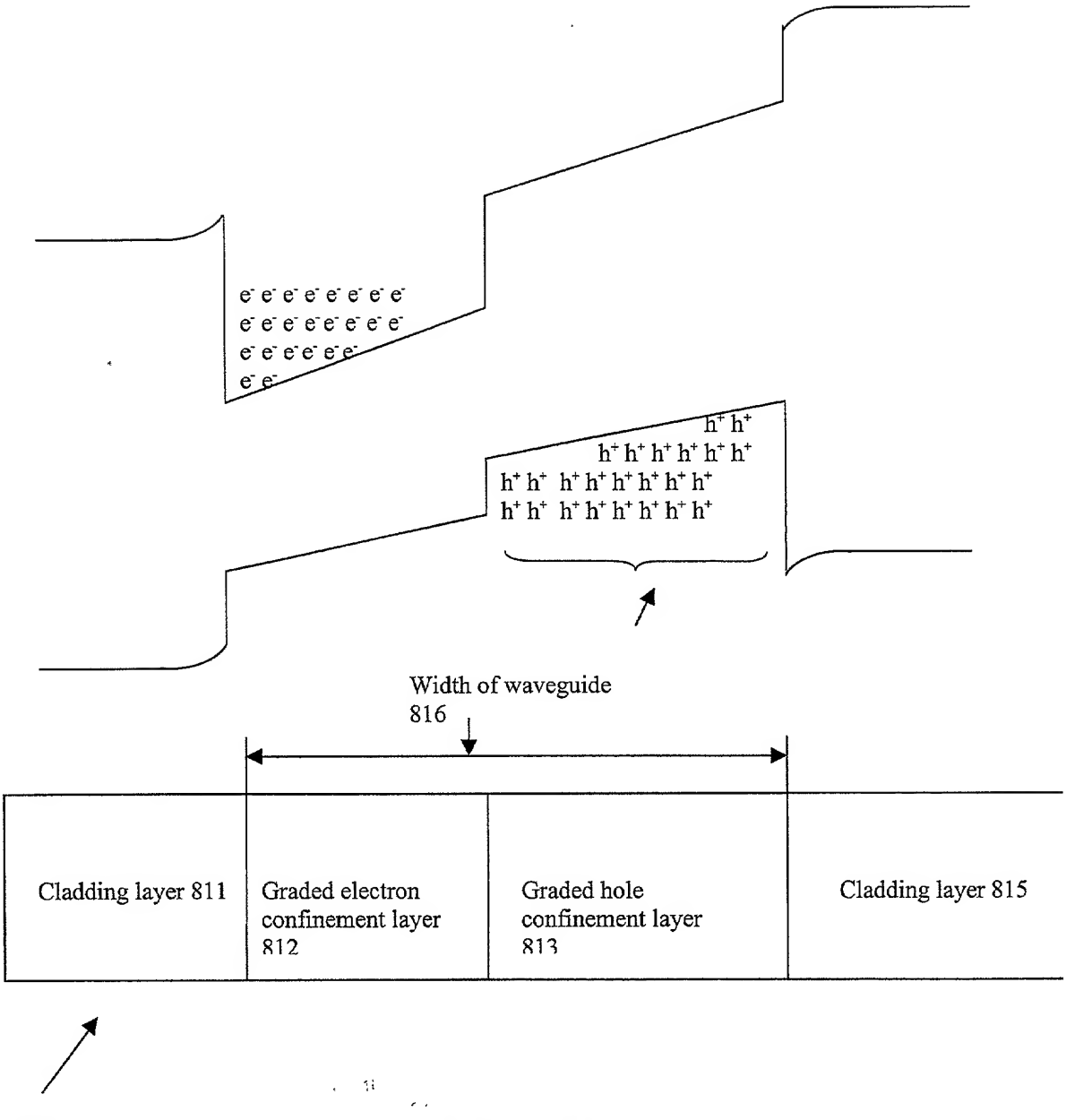
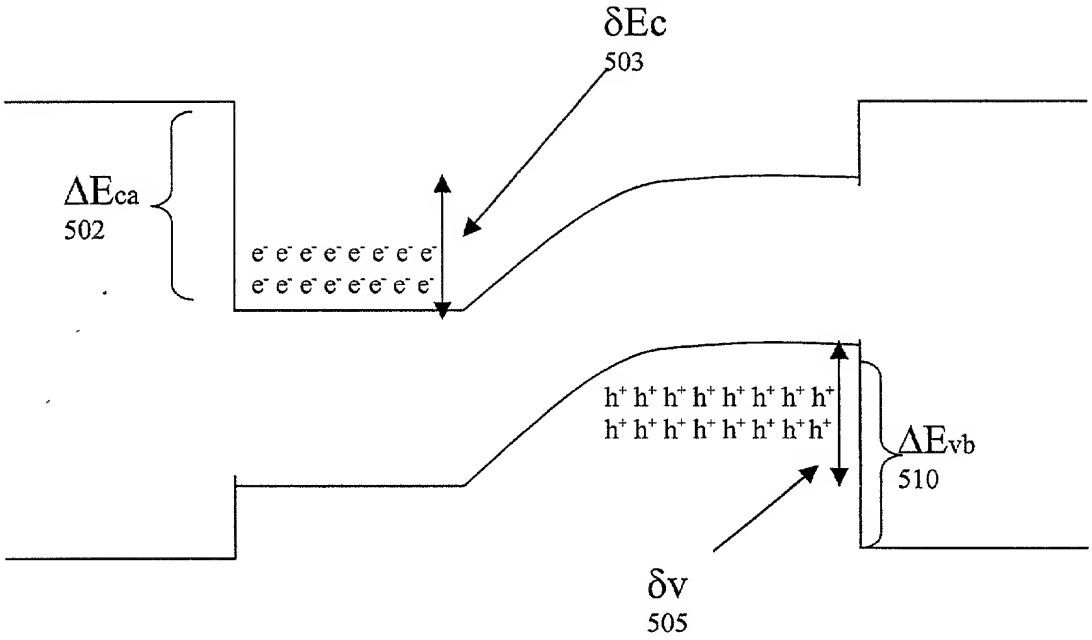

e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻
e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻ e⁻
e⁻ e⁻ e⁻ e⁻ e⁻ e⁻
e⁻ e⁻
h⁺ h⁺
h⁺ h⁺ h⁺ h⁺ h⁺ h⁺
h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺
h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺ h⁺
Width of waveguide
816
Cladding layer 811
Graded electron confinement layer 812
Graded hole confinement layer 813
Cladding layer 815
800

FIG. 17



Cladding layer 511	A – electron confinement layer 512	Graded layer 513 A → B	B - hole confinement layer 514	Cladding layer 515

500

FIG. 18

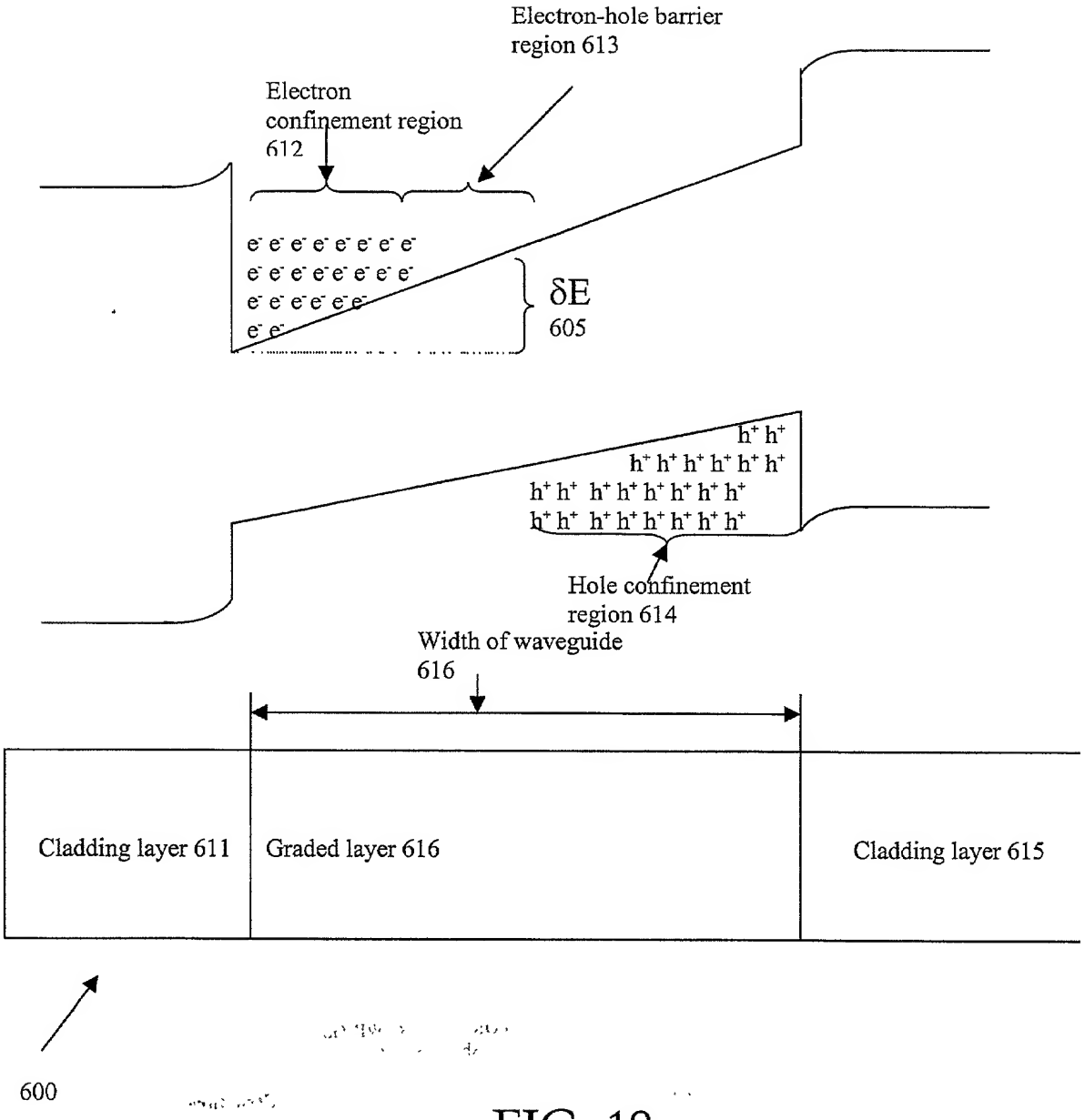

Electron-hole barrier region 613
Electron confinement region 612
δE 605
Hole confinement region 614
Width of waveguide 616
Cladding layer 611
Graded layer 616
Cladding layer 615
600

FIG. 19

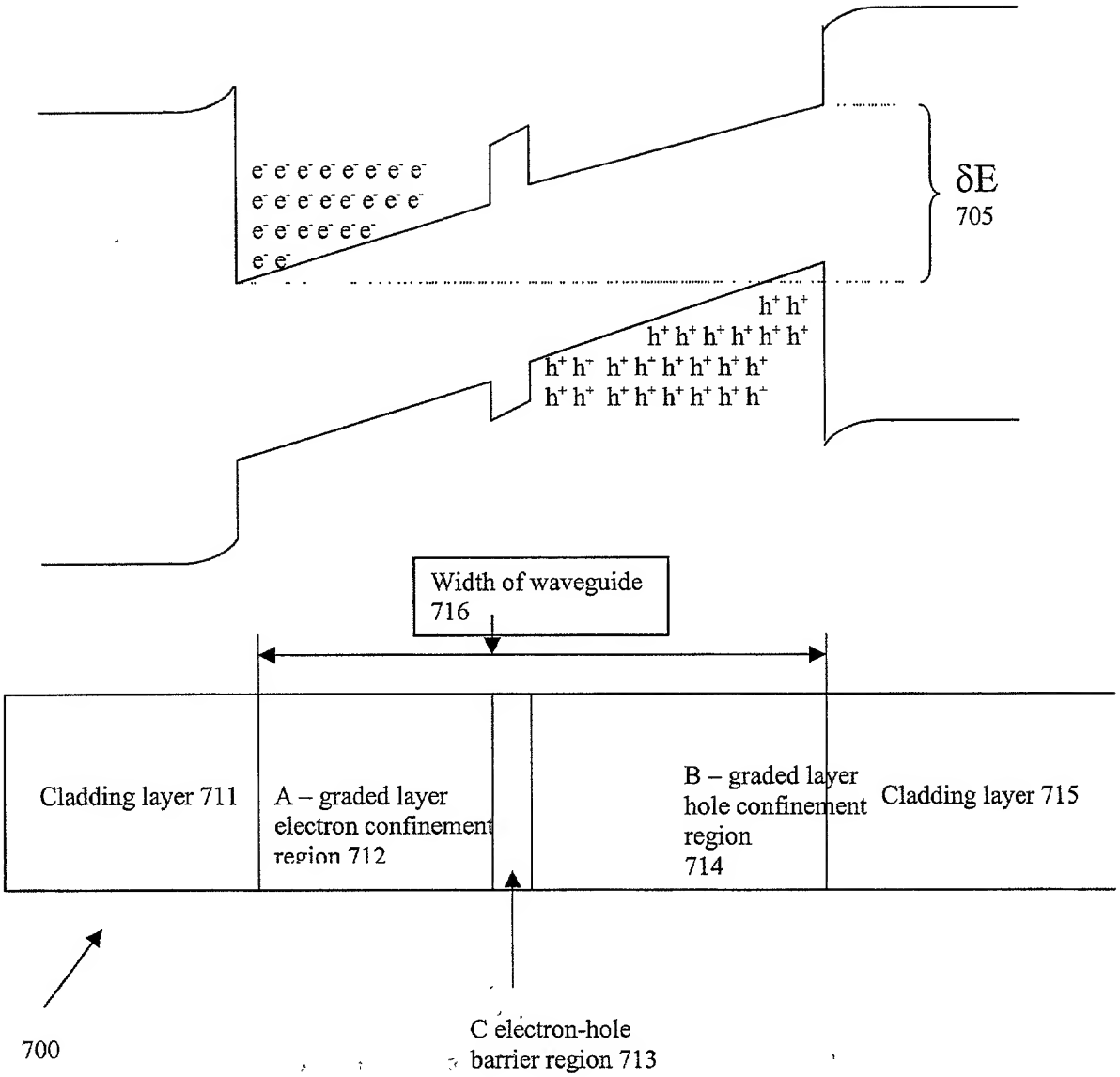

δE
705
Width of waveguide
716
Cladding layer 711
A – graded layer
electron confinement
region 712
B – graded layer
hole confinement
region
714
Cladding layer 715
700
C electron-hole
barrier region 713

FIG. 20

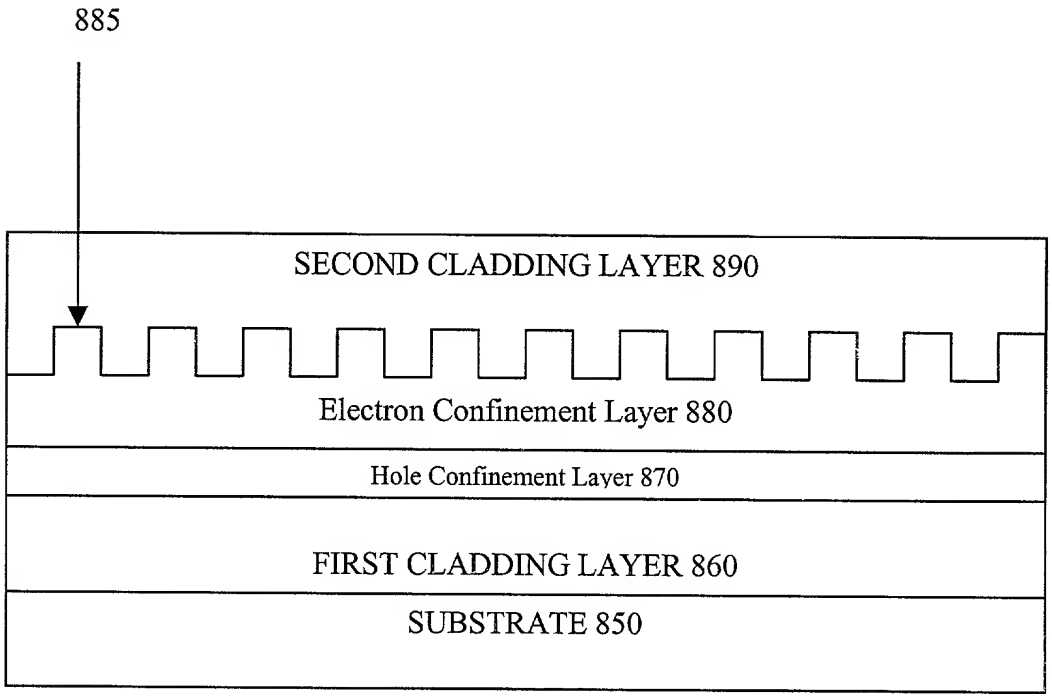

885
SECOND CLADDING LAYER 890
Electron Confinement Layer 880
Hole Confinement Layer 870
FIRST CLADDING LAYER 860
SUBSTRATE 850

FIG. 21

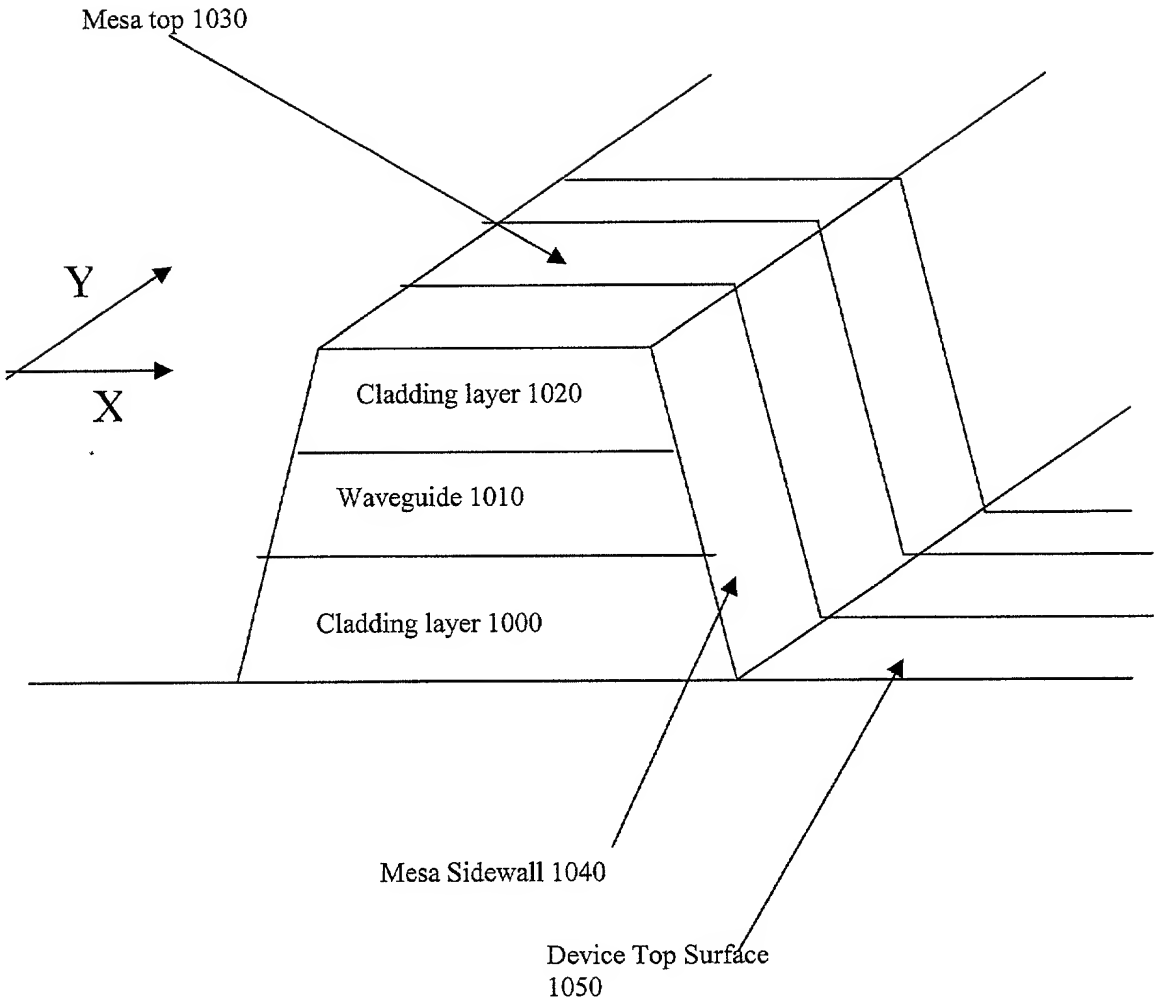

Mesa top 1030
Y
X
Cladding layer 1020
Waveguide 1010
Cladding layer 1000
Mesa Sidewall 1040
Device Top Surface
1050

FIG. 22

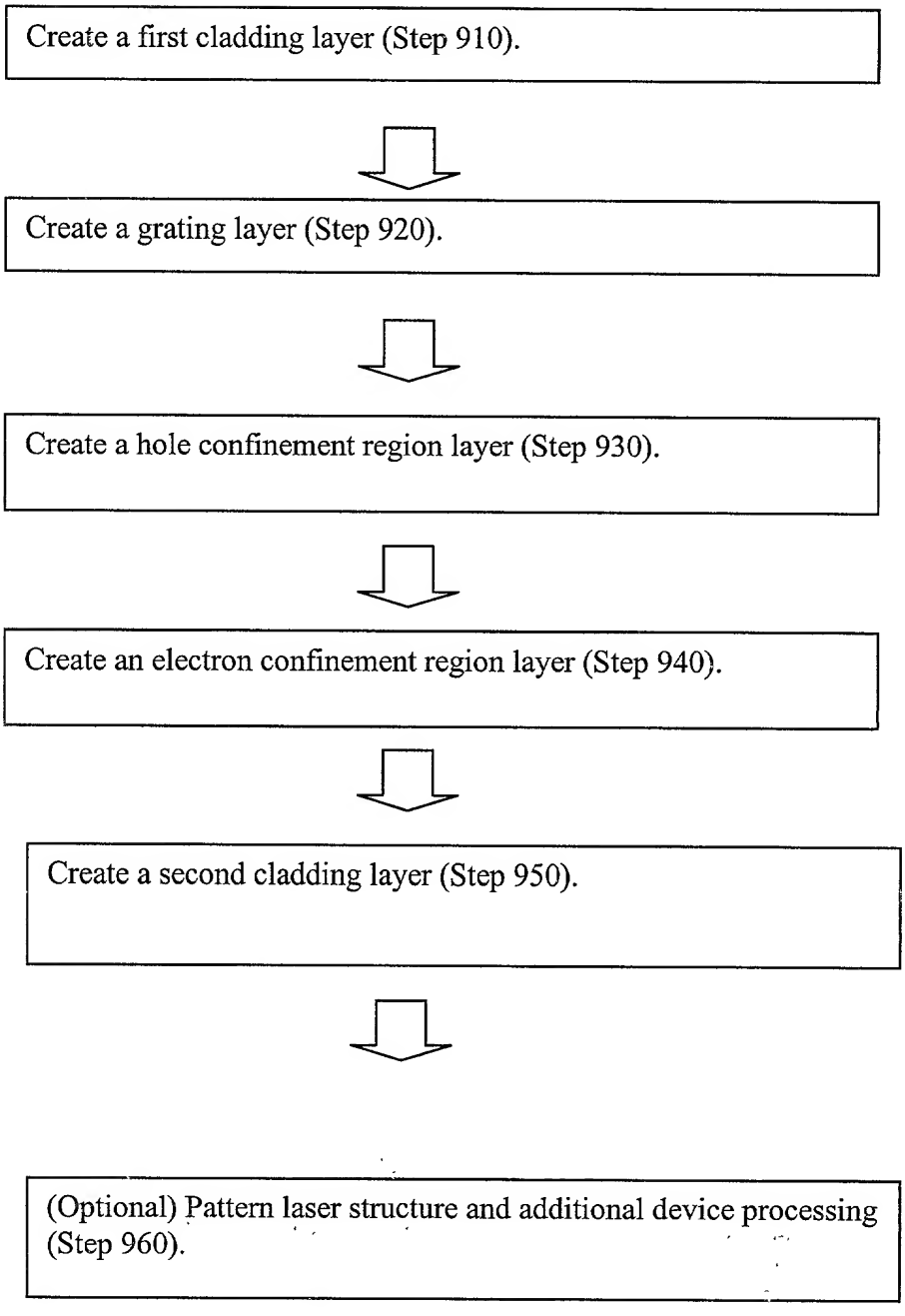

Create a first cladding layer (Step 910).
Create a grating layer (Step 920).
Create a hole confinement region layer (Step 930).
Create an electron confinement region layer (Step 940).
Create a second cladding layer (Step 950).
(Optional) Pattern laser structure and additional device processing (Step 960).

FIG. 23